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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : G08B 21/00 — A2

(11) International Publication Number: **WO 00/26882**

(43) International Publication Date: 11 May 2000 (11.05.00)

(21) International Application Number: PCT/US99/25554

(22) International Filing Date: 29 October 1999 (29.10.99)

(30) Priority Data:
60/106,404 30 October 1998 (30.10.98) US

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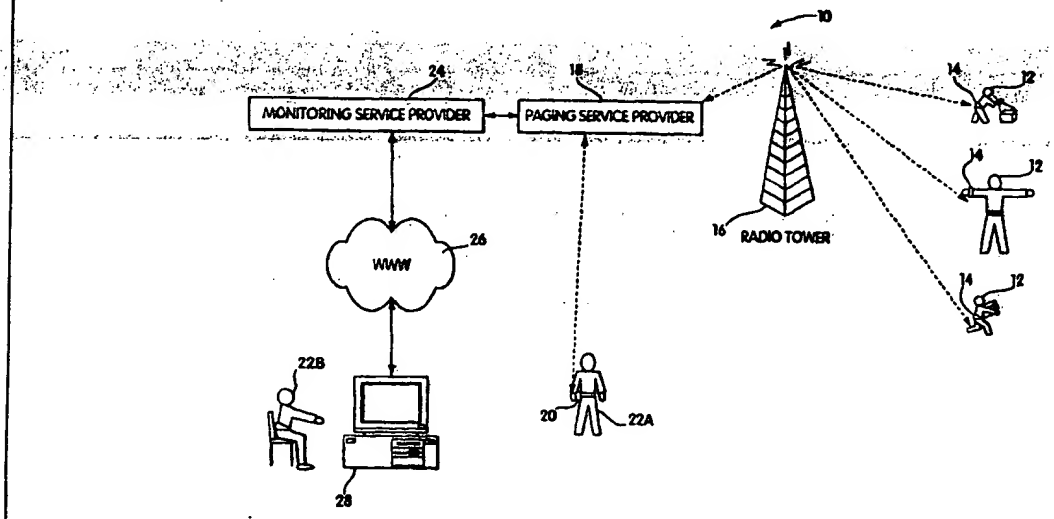
(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
Without international search report and to be republished upon receipt of that report.

(54) Title: MONITORING PHYSICAL AND ENVIRONMENTAL CONDITIONS OF A PERSON



(57) Abstract

A monitoring device includes a sensor that generates signals corresponding to at least one physical or environmental condition relating to the person; a processor that processes the signals to determine a characteristic of the condition; and a transmitter that transmits a message to a telecommunication service provider in response to the determined characteristic of the physical or environmental condition. The telecommunication service provider can be any type of telecommunication service provider including a paging service provider (18), a local service provider, a long-distance service provider, an internet service provider, a cellular phone service provider, or any combination of these service providers. The message can then be forwarded to a subscriber of a monitoring service provider. The monitoring service provider (24) can provide various graphical user interface windows over a network, such as the World Wide Web (26), to the subscriber to view the information.

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MONITORING PHYSICAL AND ENVIRONMENTAL CONDITIONS OF A PERSON

Cross Reference To Related Applications

This application claims priority from U.S. Provisional Application Serial No. 60/106,404, filed October 30, 1998, incorporated in its entirety by reference.

Background

This invention relates to monitoring physical and environmental conditions of a person.

Nowadays, more and more children and elderly are entrusted to third party care providers. Most of these care providers provide good care. However, some care providers neglect or even abuse those under their care. They may leave a child or an infirm elderly in a hot car or on a cold porch. They may ignore a baby's continuous crying. They may rarely take an infirm elderly person out of a building for a walk outside. They may even hit, shake, or physically abuse a child or elderly person. Hence, parents or guardians of children, and the children or guardians of elderly persons, are often afraid that a particular care provider may be neglectful or even abusive.

Even without third party care providers, people often wish to monitor the health and condition of their loved ones.

There are currently some tools available for monitoring people. For example, parents can install hidden video cameras to make a video tape recording of the care provided to their child when the parents are absent from the home. Similarly, audio baby monitors are commonly placed in a baby's room to permit a parent in another room to hear if the baby is distressed.

Summary

In one general aspect, the invention features a sensor that generates signals corresponding to at least one physical or environmental condition relating to the person; a processor that processes the signals to determine a characteristic of the condition; and a transmitter that transmits a message to a telecommunication service provider in response to the determined characteristic of the physical or environmental condition.

Embodiments of this aspect of the invention may include one or more of the following features.

The telecommunication service provider can be any type of telecommunication service provider including a paging service provider, a local service provider, a long-distance service provider, an internet service provider, a cellular phone service provider, or any combination of these service providers. The transmitter can be a transmitter designed to communication with the appropriate service provider. In one embodiment, the telecommunication service provider is a paging service provider and the transmitter is a paging transmitter where the transmitted message includes data representing the determined characteristic which can be an alarm condition.

Another sensor can generate signals corresponding to at least one other physical or environmental condition relating to the person. The processor processes those signals from the at least one other sensor to determine the characteristic of the physical or environmental condition.

Processing the signals can include comparing a value associated with the signals to a predetermined threshold. A memory can store information controlling operations of the processor and a receiver that receives instructions, through the telecommunication service provider, modifying the information.

The sensor can be coupled to a portable frame constructed to be attached to a person. The processor and the transmitter can be coupled to the frame. The frame can be a housing. The sensor can be an ambient temperature sensor, an accelerometer, or an audio sensor.

The transmitter can transmit an a status OK message to the telecommunication service provider.

In another aspect, the invention features a portable frame; a sensor, coupled to the portable frame, that generates signals corresponding to at least one environmental condition of a person; and a processor, coupled to the portable frame, that processes the signals to determine a characteristic of the environmental condition.

Embodiments of this aspect of the invention may include one or more of the following inventions.

The environmental condition may caused by the person, in which case, it may include crying by the person. The environmental condition can also be caused by a second person, in

which case, it force being applied by the second person to the first person, or the second person shouting at the first person. The transmitter may transmit a message to a telecommunication service provider in response to the determined characteristic of the environmental condition.

In yet another aspect, the invention features a sensor that generates signals corresponding to at least one physical or environmental condition relating to the person; a processor that processes the signals to detect an alarm condition; and a transmitter that transmits a message indicating the alarm condition.

In yet another aspect, the invention features a receiver to receive information from a telecommunication service provider, where the information is transmitted by a portable monitoring device attached to a person, the information indicating a characteristic of at least one physical or environmental condition of the person; and a transmitter to transmit the information over a network to a computer.

Embodiments of this aspect of the invention may include one or more of the following features.

The system and the portable monitoring device includes a portable frame constructed to be attached to the person; a sensor, coupled to the frame, generating signals corresponding to the at least one physical or environmental condition relating to the person; and a processor, coupled to the frame, processing the signals to determine the characteristic of the physical or environmental condition.

A network port can be provider for connection to the network, for example, the World Wide Web.

In yet another aspect, the invention features a receiver to receive information from a telecommunication service provider, where the information is transmitted by a portable monitoring device attached to a person, the information indicating a characteristic of at least one physical or environmental condition of the person; and a database to store data corresponding to the information.

Embodiments of this aspect of the invention may include one or more of the following features.

The system and the portable monitoring device includes a portable frame constructed to be attached to the person; a sensor, coupled to the frame, generating signals corresponding

to the at least one physical or environmental condition relating to the person; and a processor, coupled to the frame, processing the signals to determine the characteristic of the physical or environmental condition.

The stored data includes data received from the device characterizing the information. A network port can be provider for connection to the network, for example, the World Wide Web. A server connected to the network port and to the database may allows a plurality of subscribers to a service provider to connect to the server through the network to access the database. The server may cause computers of the subscribers to display a graphical user interface for accessing the database.

In another aspect, the invention features a receiver that receives information transmitted by a portable monitoring device attached to a person, the information indicating a characteristic of at least one physical or environmental condition of the person; a processor that processes the information to provide instructions to cause a computer to display on a computer display a graphical user interface that includes information corresponding to the characteristic of the physical or environmental condition of the person and an advertisement by a vendor; and a sender that sends the instructions to a computer.

Embodiments of this aspect of the invention may include one or more of the following features.

The system and the portable monitoring device includes a portable frame constructed to be attached to the person; a sensor, coupled to the frame, generating signals corresponding to the at least one physical or environmental condition relating to the person; and a processor, coupled to the frame, processing the signals to determine the characteristic of the physical or environmental condition.

In yet another aspect, the features a graphical user interface including information transmitted by a portable monitoring device attached to a person, the information indicating a characteristic of at least one physical or environmental condition of the person and an advertisement by a vendor.

In another aspect, the invention features accepting subscriptions by subscribers; and receiving information transmitted by a monitoring device selected by at least one of the subscribers, the information indicating a characteristic of at least one physical or

environmental condition of a person and forwarding the information to a computer of the subscriber.

Embodiments of this aspect of the invention may include one or more of the following features.

Advertisements are accepted from vendors and forwarded to the computer of the subscriber with the information. The subscribers may be permitted to subscribe for free or may be charged a subscription fee. A server is connected to a network where the subscribers connect to the server through the network to receive the information. The network may be the World Wide Web.

Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of the present invention, suitable methods and materials are described below. In addition, the materials, methods, and examples are illustrative only and not intended to be limiting.

Other features and advantages of the invention will be apparent from the following detailed description, and from the claims.

Brief Description of the Drawings

FIG. 1 is a schematic diagram of one embodiment of a remote monitoring system.

FIGs. 2A-D are diagrammatical sketches of one embodiment of a portable monitor used in the remote monitoring system of FIG. 1.

FIG. 3 is a schematic diagram of one embodiment of components of the portable monitor of FIGs. 2A-D.

FIG. 4 is a flowchart of one embodiment of the operation of the portable monitor of FIGs. 2A-D.

FIG. 5 is an example of rules used during operation by the portable monitor to determine whether an alarm condition exists.

FIG. 6 is a schematic diagram of one embodiment of a server of a monitoring service provider of the remote monitoring system of FIG. 1.

FIG. 7 illustrates one embodiment of a graphical user interface window displayed by a computer connected to the server of FIG. 6.

FIG. 8 is a flowchart of one embodiment of an operation performed by the server of FIG. 6 upon receiving a page message from the portable monitor.

FIGs. 9-10 are examples of graphical user interfaces displayed to the subscribers of the monitoring service provider of FIG. 1 for displaying information received from the portable monitor of FIGs. 2A-D.

FIG. 11 is a flowchart of one embodiment of an operation performed by the server of FIG. 6 in response to a request by a subscriber of the monitoring service provider of FIG. 1 to provide historical graphs of data received from the portable monitor of FIGs. 2A-D.

FIG. 12 is an example of a graphical user interface displayed to a subscriber of the monitoring service provider for inputting information for generating and displaying historical graphs of data received from the portable monitor of FIGs. 2A-D.

FIG. 13 is an example of a graphical user interface displayed to a subscriber of the monitoring service provider for displaying historical graphs of data received from the portable monitor of FIGs. 2A-D.

FIG. 14 is a flowchart of the steps taken to set the parameters used by the portable monitor during operation.

FIG. 15 is a graphical user interface displayed to a subscriber of the monitoring service provider for setting parameters used during operation by the portable monitor of FIGs. 2A-D.

FIGs. 16 and 16A show an embodiment of a disposable diaper for use with the portable monitor of FIGs. 2A-D.

Detailed Description

Referring to FIG. 1, a remote monitoring system 10 provides for monitoring physical and environmental conditions of persons 12 which may, for example, be children or elderly persons. Each one of persons 12 wears or carries a remote portable monitor 14 which includes one or more sensors for detecting physical and or environmental conditions relating to that person and generating signals corresponding to those conditions. In this embodiment, portable monitor 14 processes the signals to determine whether an alarm condition exists

indicating a condition which may require attention by a remote person (e.g., a parent).

Portable monitor 14 is capable of detecting an alarm condition based on one or both of two types of conditions of the monitored person: physical conditions and environmental conditions. Physical conditions are physiological conditions of the person such as the person's temperature, blood pressure and pulse. Environmental conditions are non-physiological conditions which have physical manifestations external to the monitored person. Environmental conditions can be caused by the person or can be caused by forces independent of the person. Environmental conditions caused by the person include, for example, crying which has an external, environmental audio manifestation caused by the person. Environmental conditions not caused by the person include ambient temperature, noise not caused by the person, force applied to the person (such as shaking), or soiledness of an incontinence pad or a diaper.

Portable monitor 14 may be powered by a battery. Because transmission to the telecommunication service providers is power consuming, the transmission may be substantially limited to when an alarm condition is detected, (and, in one embodiment, periodic reports to verify that the monitor is operating without error) in order to prolong the life of the battery. In other words, by processing and detecting an alarm condition at the monitor rather than at the remote devices, battery usage may be reduced.

In this embodiment, monitoring system 10 provides for sending monitoring information to remote devices used by persons 22A-B. The remote devices can be, for example, personal pagers such as pager 20, cell phone, personal portable computers such as laptops and notepads, or personal computers such as computer 28 connected to a network such as the World Wide Web 26 (WWW) or by receiving pages or through cellular phone connections. To do so, in this embodiment, in portable monitor 14 transmits a message to a telecommunication service provider, such as a telephone service provider, a cellular phone service provider, a paging service provider, or an internet service provider. By using existing telecommunication service providers and their networks, portable monitor 14 can send the information over a very long distance without needing new, special purpose powerful transmitters. Therefore, in this embodiment, the remote devices can receive the monitoring information so long as they are accessible by existing telecommunication service providers. Hence, person 22B can leave his or her parent in the care of a nurse in Boston and fly to

Singapore. Person 22B can easily receive information regarding the care provided to his or her parent by connecting to WWW 26.

Hence, in one embodiment and in the case of an alarm condition, portable monitor 14 transmits a page message to a relay station 16 operated by a paging service provider 18. Paging service provider 18 then either sends the page message to pager 20 or provides information based on the page message to a monitoring service provider 24. Monitoring service provider 24 then makes that information available to computer 28 through WWW 26.

FIGs. 2A-D illustrate some example embodiments of portable monitor 14. The monitors can be sized and structured to be attached to persons 12 in various manners.

Fig. 2A illustrates a portable monitor 14 integrated into a strap. The strap may be sized to fit an arm, wrist (as in FIG 2C) or waist (as in FIG. 2B) as second portion 39 may hold a battery for the monitor, and allow access for replacement through microzipper 39. Other configurations could be applied for holding the circuitry and battery, such as packaging both together (e.g., as a disposable unit) and using a number of other configurations. The strap portion of the embodiments may include attractive or entertaining packaging or designs, such as showing popular cartoon characters on bands sold to children.

FIGs. 2B-2C show two embodiments of the portable monitor 14 (illustrated in FIG. 2A). In these embodiments, portable monitor 14 is a belt or strap having a strip of hook material 32A at one end and a strip of loop material 32B at the other end to be used in combination as a hook and loop fastener for securing portable monitor 14 around the wrist or waist of the person, as appropriate. The fastening material may include a conductor or other mechanism to permit sensing of when this strap is removed, as described below. Naturally, other fastening mechanisms, such as buckles or straps that may be tied, could be used.

Portable monitor 14 also includes a portion 30 which houses circuitry 36 for performing monitoring functions of portable monitor 14 and a portion 31 which houses a battery 38. FIG. 2D illustrates one example of the housing or portion 30 for which holds circuitry 36 for the portable monitor. Circuitry 36 may include a plurality of sensors 34 that are positioned so as to be able to measure physical and environmental conditions relating to the person. Some of these sensors, such as sensor 34A, may be positioned next the skin of the person so that the sensors can sense physical conditions of the person such as the person's temperature or blood pressure. Other sensors, such as sensors 34B and 34C, may be

positioned facing away from the person so that the sensors can better sense environmental conditions relating to the person.

Where appropriate, to construct portable monitor 14, circuitry 36 can be dipped into a waterproof material that encases circuitry 36. Once solidified, the waterproof material prevents water from affecting the operation of circuitry 36 and sensors 24. Sensors 34 and circuitry 36 may then further encapsulated in a vacuum packed PVC or polyurethane material for further protection and water proofing. Battery 38, which is connected to circuitry 36, may be enveloped by PVC or polyurethane material and is accessible by a microzipper 39 (FIG. 2A) which provides a good degree of water resistance while allowing access to battery 38 for charging or replacing the battery.

FIG. 3 illustrates one embodiment of circuitry 36 of portable monitor 14. This embodiment includes a microprocessor 50 which is connected to a nonvolatile computer readable storage 52 such as an electrically erasable programmable read-only memory (EEPROM) and a random access memory (RAM) 56. In this embodiment, Microprocessor 50 is also connected to an audio processing and analysis digital signal processor (DSP) 60. DSP 60 processes audio signals in the manner described below. In some embodiments, microprocessor 50 may perform the processing tasks performed by DSP 60 and DSP 60 is omitted.

Microprocessor 50 receives data from an analog-to-digital (A/D) converter 62 that converts analog signals from sensors 34 into digital signals. Note that one, some, or all of sensors 34 can be digital sensors, in which case the signals need not be passed through A/D converter 62. Sensors 34 can be any type of sensors for measuring physical and environmental conditions including pH sensors, nitrogen sensors, olfactory sensors, skin temperature sensors, ambient temperature sensors, resistivity sensors, conductivity sensors, blood pressure sensors, and microphones. One of the sensors may be a three-axis accelerometer 58 which measures the acceleration of any movement and the direction of that movement. Global Positioning System locator 60 may be included to provide information regarding the location of the person to microprocessor 50.

Portable monitor 14 may further include a wireless communication module 64 which supports two-way paging communication according to a commonly used paging

communication standards such as FLEX™ family of protocols including ReFLEX supported by ReFLEX Suite of Application protocols marketed by Motorola, Inc.

FIG. 4 is a flowchart 100 of one embodiment of the overall operation of portable monitor 14 according to the present invention. Microprocessor 50 first receives information from the sensors, for example by polling each one of sensors 34 and obtaining a reading from each one of sensors 34 (step 102). Note that for ease of description, it is assumed that all of the sensors are polled at the same time. However, in implementation, each one of sensors 34 can be polled at different times (or interrupt the microprocessor to inform it when new path is available). For example, a temperature sensor may be polled every 10 minutes, while a microphone may be polled one hundred times every second. After obtaining the sensor readings, microprocessor 50 stores the sensor readings in RAM 56 (step 104).

Microprocessor 50 then processes the sensor readings to determine whether an alarm condition exists (step 105). An alarm condition is simply a condition requiring a report to a remote person. The alarm condition may, but need not, correspond to a condition of the monitored person which is indicative of danger or ill health.

The processing by microprocessor 50 can be logically divided into two stages: a pre-processing stage and a rule application stage. Of course, when implemented, the processing need not be implemented so as to have two distinct stages. During the pre-processing stage, microprocessor 50 calculates a set of values based on the sensor readings. The calculated values are then used during the rule application stage to determine whether an alarm condition exists. During the rule application stage, microprocessor 50 determines whether an alarm condition exists by applying a set of pre-determined rules to the values calculated from current and previous sensor readings and/or the sensor readings themselves to determine whether an alarm condition exists. An example embodiment of these stages will now be described.

As stated above, microprocessor 50 may pre-process some or all of the sensor readings (step 106). The pre-processing performed by microprocessor 50 depends on the nature of the sensor readings and the purpose for which they are to be used. In the case of the ambient temperature readings, microprocessor 50 may calculate a running average of the ambient temperature by, for example, adding the current reading to the previous running average value and dividing the result by 2. In the case of the skin temperature readings, microprocessor 50 may also calculate a running average of the skin temperature. In the case of audio signals (or

other signals where desired), microprocessor 50 may send the signals to audio processing and analysis DSP 60 (or other co-processing unit) to be processed. DSP 60 calculates the frequency components of the audio readings by, for example, performing a Fourier analysis. DSP 60 then determines the intensity component of the audio reading by determining the amplitude of the reading. DSP 60 next determines the duration of a particular audio signal by, for example, determining the time since the previous trough in the audio signals. DSP60 may be programmed to perform audio filtering and other audio functions.

In the case of readings from accelerometer 58, microprocessor 50 may determine the velocity components of the motion readings, for example, by integrating the acceleration values from accelerometer 58. Microprocessor 50 may also determine the degree of change in acceleration over time, for example, by computing a derivative of the acceleration value. The derivative value is one way to allow determining whether person 12 is being jerked suddenly in one direction and then another, as may be the case with when a child is shaken violently. Microprocessor 50 then calculates the force of the motion by calculating the force in a particular direction based on a pre-defined mass value and the direction reading from accelerometer 58.

After any pre-processing the signal readings that are performed, microprocessor 50 may apply a set of rules to the signal readings, the calculated values, and previous signal readings and values, as appropriate, to determine whether an alarm condition exists. Various rules may be devised to determine when an alarm condition exists. Depending on the sensed conditions and any other parameters or design concerns.

FIG. 5 outlines an example of a set of rules that may be applied by microprocessor 50 to determine whether an alarm condition exists. In this example, a rule is typically one or more condition statements, combined by Boolean logic, which when satisfied results in microprocessor 50 to set an alarm condition flag. The conditions may be based on current sensor readings (such as rules 138-140) or a combination of the current and previous sensor readings (rules 122-136). In addition, the conditions may be based on the actual sensor readings or pre-processed values either from a single sensor (rules 122-128 and 134-140) or from multiple sensors (rules 130-132).

Rules may (or may not) include a high degree of sophistication and complexity. In the case of audio signals, for example, the rules can take into account an expected audio profile

and characteristics of an event. For example, crying by a child is typically characterized by sporadic fits, varying intensity, and a particular frequency envelope. In contrast, when a care taker shouts at a child, the expected characteristic and audio profile is different. Hence, in the case of crying, the rule can ignore short pauses in determining a duration of a crying episode and can require a particular frequency content and a particular level of intensity. In the case of shouting at a child, the rule can require a frequency envelope associated with human speech, a high degree of continuity, and a high degree of intensity. In a very sophisticated system, the monitor could even be tuned to recognize an individuals voice and/or perform speech recognition.

Referring back to FIG. 4, if an alarm condition exists (step 110), microprocessor 50 prepares a page message to be sent by two-way paging transmitter 64 (Fig. 2) to paging service provider 18 (step 112). The page message may include various types of data ranging from a mere flag that indicates that an alarm condition exists to detailed information regarding the nature of the alarm condition, sensor readings, historical sensor readings, and other information (FIG. 7).

According to one embodiment, the monitor will issue an "ok" status message periodically. The "ok" status message permits a monitoring person or service to have comfort that no alarm condition has occurred and the system is operating normally. Accordingly, in this embodiment, if an alarm condition does not exist, then microprocessor 50 determines the period of time since when a status OK page message was sent (step 114). If this period of time is greater than a pre-determined period of time, here 20 minutes, then a status OK page message is sent (step 116).

According to one embodiment of the invention, the "ok" status message may be sent to the remote monitoring person, e.g., 22A of FIG 1. According to another embodiment, the "ok" status message may be sent only to the monitoring service provider 24. In this case, the monitoring service provider would assure that the "ok" status messages are being received according to the appropriate time interval. In the event that an "ok" message is not received within the appropriate time interval, the monitoring service provider could then generate an alarm condition which results in a page issuing to the remote monitoring person 22A (as well as a message over the worldwide web 26, in embodiments that include that aspect).

In some embodiments, all page messages include data from GPS locator 60. The information can be used to ensure that person 12 does not (or does) leave a particular area. This feature is particularly useful for preventing kidnapping and for ensuring children and elderly are taken for walks.

In another embodiment, portable monitor sends an alarm condition page message when portable monitor 14 is removed from the person. To implement, hook and loop fastener material 32A-B can include electrically wired components which, when the fastener is opened, cause a signal to be sent to microprocessor 50 which then sends an appropriate page message. Other mechanisms can be used to determine when the portable monitor 15 has been removed from the monitor person. For example, if the monitored person's temperature is being sensed and that temperature suddenly falls to the ambient temperature, the monitor has likely been removed.

Referring back to the example of FIG. 1, after a page message is sent by communication module 64, the page message is received by relay station 16 and forwarded to paging service provider 18. As described above, paging service provider 18 can forward the message as a page to pager 20 of person 22A. Alternatively or in addition, paging service provider 18 can send the information to monitoring service provider 24, which may determine when and how to issue alarm messages to the remote person (22a of FIG. 1).

We will now describe the structure and operation of monitoring service provider 24.

In FIG. 6, monitoring service provider 24 includes a server 250. Server 250 includes an interface 252 for receiving messages from paging service provider 18. Interface 252 is connected to a microprocessor 254. Microprocessor 254 is connected to a database 256 and a random access memory (RAM) 258. Microprocessor 254 is also connected to an I/O port 260 that allows microprocessor 254 to send information through WWW 26 and to receive information from WWW 26. Note that interface 252 may be the same as I/O port 260 and receive the information from paging messaging service provider 18 through WWW 26.

Monitoring service provider 24 accepts subscriptions from subscribers (e.g., the parents of a child to be monitored) and allows them to monitor data sent by one or more portable monitors 14. The subscribers may be required to pay a subscription fee or may be allowed to subscribe for free. Monitoring service provider 24 can also receive revenue from

vendors who wish to advertise various graphical user interface windows displayed to the subscribers of monitoring service provider.

A subscriber can log on to monitoring service provider 24 by connecting to server 250 over WWW 26, although other mechanisms may be used to connect to the monitoring service, such as a modem or (without even using a computer) an automated or live telephone answering system. In the embodiment of FIG. 6, server 250 sends an HTML (HyperText Markup Language) file that causes computer 28 to display a home page graphical user interface (GUI) window 200. GUI 200 provides a menu strip 202 that includes various "buttons" on which the subscriber can click to cause server 250 to perform various functions. Buttons 204, 206, and 208 cause server 250 to send information to computer 28 received from portable monitors 14 attached to persons whose care the subscriber wants to monitor. For example, button 204 allows the subscriber to receive information with respect to his or her baby. Button 206 allows the subscriber to receive information relating to his or her parent. Button 208 allows the subscriber to receive information relating to a toddler, preschooler, or an older child. Button 203 provides information that may be of interest to the subscriber such as community resource information, literature relating to raising children or taking care of elderly parents, links to various on-line shopping sites which provide products particularly applicable to young children or the elderly, and other useful information. Of course, many different forms and types of interfaces could be used.

Upon clicking on one of the buttons 204-208, server 250 sends an HTML file to display a graphical user interface window to obtain the subscriber's user name and password. After verifying the information, if there is information on server 250 which has not yet been sent to computer 28, server 250 sends that information and displays it in a graphical user interface window such as the one shown in FIG. 9, described below GUI window 200 can also include advertisement by vendors who are interested in reaching persons who have babies or young children, or who take care of elderly parents. Such advertisement, for example, can be included in region 210.

During operation, when portable monitor 14 sends a paging message to paging service provider 18 which in turn forwards that message to server 250 of monitoring service provider 24, the message is received at interface 252 and forwarded to microprocessor 254. In

response to the paging message, microprocessor 254 may execute a routine, a flowchart of one embodiment of which is shown in FIG. 8.

After receiving the paging message (step 300), microprocessor 254 stores the information in the paging message in database 256 in association with a unique identification code identifying portable monitor 14 and the name or identification code of the subscriber to whom the paging message relates (step 302). In the embodiment illustrated in FIG. 8, an example of a database 307 is illustrated. According to this example, a unique identifier is associated with each subscriber. The database would include additional information logging all of the applicable information for the subscriber, such as alarm conditions and the status of reception of "ok" messages if any. After saving the information, microprocessor 254 determines whether the subscriber is logged on to monitoring service provider 24 (step 304). If not, microprocessor 254 terminates the routine.

According to one embodiment, if the subscriber is not logged on (or even if the subscriber is logged on), the monitoring service may issue a page to notify the remote person that an event had occurred. In this embodiment, the (in referring to FIG. 1) the paging of the remote person 22A is initiated by the monitoring service provider 24. Thus, an alarm condition (or status message) issues from the monitor person 12 to the paging service provider 18, which forwards that information to monitoring service provider 24. Monitoring service provider 24 may then determine whether a page should be issued to the remote person 22A. In addition, the monitoring service provider would determine and implement issuing information over the worldwide web 26 to a web site that the remote person 22A could access using a computer or other device.

If the subscriber is logged on to monitoring service provider 24, then microprocessor 254 generates and sends an HTML (HyperText Markup Language) file containing data received from portable monitor 14 to computer 28 of the subscriber. The HTML file causes computer 28 to display the information in a graphical user interface (GUI) window to subscriber 20B. In any event, that information would be made available through access to a web site. two embodiments of such a GUI window will now be described in reference to FIGs. 9 and 10.

Referring to FIG. 9, a monitoring graphic user interface window 350 includes a region 352 in which a log of various events detected by portable monitor 14 and sent to monitoring

service provider 24 are displayed. In a region 352, for each event, the time of occurrence of the event, the nature of the event, and the duration of the event is displayed. In a region 353, an advertisement by a vendor is included.

Monitoring GUI window 350 also includes a menu strip 354 where the subscriber can select one of seven options by "clicking" on the appropriate button.

A setup button 356 allows the subscriber to modify various setup parameters of portable monitor 14, as will be described below. The setup characteristics which can be modified include the sensitivity of portable monitor 14, the amount of information sent by portable monitor 14, the frequency of status OK signals sent by portable monitor 14, and other parameters. An emergency button 358 causes computer 28 to send a message to monitoring service provider 24 indicating that an alarm condition exists and that monitoring service provider 24 is to contact authorities to provide emergency care for the person being monitored.

An export information button 360 allows a user to down load data stored in database 256 and export the data to other applications such as commercial spreadsheet and word processing applications. A graph button 362 causes computer 28 to send a message to monitoring service provider 24 to analyze data stored in database 256 and to provide various historical graphs and charts based on the historical data stored in database 256, as will be described in detail below. A support button 366 allows subscriber 22B to access on-line and off-line technical support resources of monitoring service provider 24. A home button 368 allows subscriber 22B to return to the home page of monitoring service provider 24, such as the one shown in FIG. 7.

A monitor strip button 364 causes window 350 to be reduced in size in this example, so that only two types of information are displayed in a reduced size monitoring strip GUI window 400 shown in FIG. 10. In the reduced monitoring strip GUI in the example of window 400, two types of information are displayed. In region 402, an advertisement by a sponsor of monitoring service provider 24 is displayed. In region 404, the latest data from portable monitor 14 is displayed. The advertisements in region 402 may change more frequently than the update rate of information sent by portable monitor 14. This would permit a person to monitor a child (for example) while also performing other work on the computer.

Because the advertisement id displayed (and may be periodically updated or changed) very focused advertising can be offered to a guaranteed audience.

A child's physical and environmental conditions is that each child behaves differently and has a different temperament than another child. In some embodiments, portable monitor 14 can be modified to have different thresholds depending on a particular child (or person being monitored). One technique is to monitor the child's physical and environmental conditions over a period of one or two days when the child is in his or her parent's care. That data may then be analyzed, either manually or by a computer, to provide a set of base line thresholds for that particular child. For example, a child who cries very loudly may require a different noise threshold than a child who cries more quietly. In addition, a child who is colicky and cries regularly at a set time in the afternoon may require an intelligence built into alarm condition rules of portable monitor 14 which distinguishes such a crying episode than one that may occur at an unusual time. Another technique is to simply input the parameters used to monitor a patient.

By allowing generating various graphs based on the historical data, monitoring service provider 24 can also allow for intelligent adjustments (manually or automatically) in the rules stored in a portable monitor for detecting an alarm condition. In addition, monitoring service provider 24 allows a subscriber to modify the rules stored in a portable monitor for detecting an alarm condition from a remote location making such adjustment easy and convenient. These features will now be described in detail.

Referring back to FIG. 9, if the subscriber clicks on graph information button 362, a request to send to server 250 to begin a process of generating historical graphs based on data stored in database 256. FIG. 11 is a flowchart 450 of the steps taken by server 250 to generate such historical graphs. After receiving the request for generating the historical graphs (steps 452), server 250 sends an HTML file to computer 28 which causes computer 28 to display a GUI window 500 (shown in FIG. 12) to receive input from the subscriber with respect to the type of historical graphs the subscriber desires (step 454). After the user has input the information into computer 28, and computer 28 sends that information to server 250, server 250 receives the subscriber input data in the form of an HTML file (step 456). Based on the subscriber input data, server 250 retrieves the necessary historical data from database 256 (step 458). Server 250 then generates the historical graphs (step 460). The generated graphs

are then encapsulated in an HTML file (step 462) and sent to computer 28 which then displays the graphs in a GUI window such as the one shown in FIG. 13 (step 462), described above.

Referring to FIG. 12, as stated above, a GUI window 500 may be displayed to the user to allow the user to input information for generating historical graphs. In a region 502, the user can select a graph number and input a title for that graph number. The subscriber can also select a graph type such as a line graph, a bar chart, a pie chart, and so on. In this example, the subscriber can then select up to three variables in region 504 to be graphed against one another. The variables can be information sent by portable monitor 14 or time expressed in various increments. An indicator 506 indicates a currently selected variable which the subscriber is inputting. In a region 508, the subscriber can select a lower and an upper limit for the variable. In the case of variables sent by portable monitor 14, the lower and upper limits allow focusing on a particular range of information. In the case of time variables, the lower and upper limits allow focusing on a particular period of time. After finalizing the graph information, the subscriber can click on a send button 510 which causes computer 28 to encapsulate the information in an HTML file to be sent to server 250. The subscriber can also cancel the operation by clicking on a cancel button 520. It should be noted that the graph information input by the subscriber can be stored by server 250 and retrieved by the subscriber by graph title or graph number input in region 502. (In other embodiment, the log information can simply be downloaded to a remote computer, with processing and packaging of the information occurring at the remote computer.)

Referring to FIG. 13, as described above, server 250, after generating the graphs, sends an HTML file which includes information for displaying the graphs by computer 28 (step 464 in FIG. 11). That HTML file causes computer 28 to display a graph GUI window 550 in which the various graphs are displayed to the subscriber.

Referring back to FIG. 9, the subscriber can select to change the configuration of the parameters of portable monitor 14 by clicking on setup button 356. FIG. 12 is a flowchart 600 of one embodiment of steps taken by server 250, paging service provider 18, and portable monitor 14 to implement the setup modification request by the subscriber. After receiving the setup request sent by the subscriber (step 602), server 250 sends an HTML file to computer 28 to cause computer 28 to display a setup GUI window 650 (shown in FIG. 15). GUI window 650 allows the subscriber to input information indicating a new set of parameters to be sent to

portable monitor 14. Computer 28 then encapsulates that information in an HTML file and sends the information to server 250. Upon receiving that HTML file (step 606), server 250 creates a page message to be sent to portable monitor 14 via paging service provider 18. The page message includes the new information input by the subscriber and a unique identification code assigned to portable monitor 14 which allows portable monitor 14 to verify the page message is proper.

Additional safety precautions may be included at this stage. For example, if the subscriber requests a set of parameters which monitoring service provider 24 considers as not providing adequate monitoring, an employee of monitoring service provider 24 can contact the subscriber to verify the information and to further discuss the new parameters. In another embodiment the monitoring service provider can send an e-mail stating that the new parameters were invalid and that the previous parameters were left unchanged. Such an email may also include an explanation and a range of acceptable parameters.

After sending the page message to paging service provider 18 (step 608), paging service provider 18 forwards the information to portable monitor 14 (steps 610). Portable monitor 14 then receives that page message (step 612) and confirms that the message includes the portable monitor's unique identification code (step 614). If the message does not contain the proper unique identification code, then portable monitor 14 sends a refusal page message to be forwarded by paging service provider to server 250 (step 616). If the page message from server 250 includes the proper unique identification code, portable monitor 14 updates its setup information (step 618) and sends an information page message indicating that the setup information was updated (step 620).

After receiving the confirmation or the refusal page message from portable monitor 14 (step 622), server 250 first determines whether the page message is a refusal message or a confirmation message (step 624). If a confirmation message, server 250 updates database 256 with the new setup information (step 626) and sends an appropriate HTML file indication that portable monitor 14 received the new setup information and was accordingly updated (step 628). If the page message received from portable monitor 14 is a refusal message, then server 250 does not update database 256 and sends an appropriate HTML file indicating that portable monitor 14 was not updated with the new setup information (step 630).

As indicated, in step 604, server 250 sends an HTML file which causes computer 28 to display a setup GUI window 650 to the subscriber. Referring to FIG. 15, setup GUI window 650 includes a region 652 in which the various setup information is displayed to the user. The user can select any one of the setup variables by clicking on the particular variable name. When the subscriber selects a variable, an indicator 654 indicates the variable is selected. The variable is then displayed in a region 656 together with its current value. The subscriber can then change the current value and input a new value and region by inputting a new value and region 658. The new input value is then displayed in region 652. After completing the changes, the subscriber can click on a send button 650 which causes an HTML file to be sent to server 250. The HTML file includes the various user input data to be sent to portable monitor 14. The subscriber can also select to cancel the operation by clicking on a cancel button 652. The subscriber can also select to print a printout of the current setup values by clicking on a print button 654. Additionally the subscriber can restore all of the setup values to the factory installed setup values by clicking on a restore button 666.

Referring to FIGs. 16 and 16A, in one embodiment, portable monitor 14 is integrated or attached to a diaper or incontinent pad 704, or receives an input from the diaper or pad. In these embodiments, a sensor 702 may be located in the disposable diaper or pad 704. For example, sensor 702 can be a pH sensor or a wetness sensor which can indicate when diaper 704 needs to be changed. If the pH reading or wetness is above a certain level, indicating a high acidic content, then a page message (alarm condition) is forwarded by communication module 64 to indicate that the diaper or incontinence pad needs to be changed. Sensor 702 can be connected to a wire 706 which is in turn connected to a sensor connection portion 708. Sensor connection portion 708 allows for connecting a wire 710 leading to portable monitor 14. In one embodiment connection portion 708 can be loop material of a hook and loop fastener.

Some or all of the loop material in portion 708 (or loop and hook material 32A and 32B of FIG. 2A) can be composed of conductive or semi-conductive material such as graphite fibers, metals, or doped polycrystalline silicon. Wire 710 in turn can be connected to hook material 712 of the hook and loop fastener. Hooks of the hook material 712 can also be composed of conductive material or semiconductive material such as graphite, fiber, metals, or doped polycrystalline silicon. Hence, when hook material 712 comes into contact with

connection portion 708 as shown in FIG. 17A a connection is made between wire 710 and wire 706 causing sensor 702 to be connected to portable monitor 14. Other mechanisms, including wireless communication, could be used.

In one embodiment, in the case of an alarm condition, portable monitor 14 also sounds an alarm (or beeps).

The computer systems described above typically include a main unit connected to both an output device which displays information to a user and an input device which receives input from a user. The main unit generally includes a processor connected to a memory system via an interconnection mechanism. The input device and output device also are connected to the processor and memory system via the interconnection mechanism.

One or more output devices may be connected to the computer system. Example output devices include a cathode ray tube (CRT) display, liquid crystal displays (LCD), printers, communication devices such as a modem, and audio output. One or more input devices may be connected to the computer system. Example input devices include a keyboard, keypad, track ball, mouse, pen and tablet, communication device, and data input devices such as sensors. It should be understood the invention is not limited to the particular input or output devices used in combination with the computer system or to those described herein.

Each computer or microcontroller system may be a general purpose computer system which is programmable using a computer programming language, such as C++, Java, or other language, such as a scripting language or assembly language. The computer system may also include specially programmed, special purpose hardware. In a general purpose computer system, the processor is typically a commercially available processor, of which the series x86, Celeron, and Pentium processors, available from Intel, and similar devices from AMD and Cyrix, the 680X0 series microprocessors available from Motorola, the PowerPC microprocessor from IBM and the Alpha-series processors from Digital Equipment Corporation, are examples. Many other processors are available. Such a microprocessor may execute a program called an operating system, of which Windows NT, Linux, UNIX, DOS, VMS and OS8 are examples, which controls the execution of other computer programs and provides scheduling, debugging, input/output control, accounting, compilation, storage assignment, data management and memory management, and communication control and

related services. The processor and operating system define a computer platform for which application programs in high-level programming languages are written.

A memory system typically includes a computer readable and writeable nonvolatile recording medium, of which a magnetic disk, a flash memory and tape are examples. The disk may be removable, known as a floppy disk, or permanent, known as a hard drive. A disk has a number of tracks in which signals are stored, typically in binary form, i.e., a form interpreted as a sequence of one and zeros. Such signals may define an application program to be executed by the microprocessor, or information stored on the disk to be processed by the application program. Typically, in operation, the processor causes data to be read from the nonvolatile recording medium into an integrated circuit memory element, which is typically a volatile, random access memory such as a dynamic random access memory (DRAM) or static memory (SRAM). The integrated circuit memory element allows for faster access to the information by the processor than does the disk. The processor generally manipulates the data within the integrated circuit memory and then copies the data to the disk when processing is completed. A variety of mechanisms are known for managing data movement between the disk and the integrated circuit memory element, and the invention is not limited thereto. It should also be understood that the invention is not limited to a particular memory system.

The database 256 may be any kind of database, including a relational database, object-oriented database, unstructured database or other database. Example relational databases include Oracle 8i from Oracle Corporation of Redwood City, California, Informix Dynamic Server from Informix Software, Inc. of Menlo Park, California, DB2 from International Business Machines of Yorktown Heights, New York, and Access from Microsoft Corporation of Redmond, Washington. An example object-oriented database is ObjectStore from Object Design of Burlington, Massachusetts. An example unstructured database is Notes from the Lotus Corporation, of Cambridge, Massachusetts. A database also may be constructed using a flat file system, for example by using files with character-delimited fields, such as in early versions of dBASE, now known as Visual dBASE from Inprise Corp. of Scotts Valley, California, formerly Borland International Corp.

Various computer platforms, processors, or high-level programming languages can be used for implementation. Additionally, the computer system may be a multiprocessor computer system or may include multiple computers connected over a computer network.

Each module described above may be separate modules of a computer program, or may be separate computer programs. Such modules may be operable on separate computers. Data may be stored in a memory system or transmitted between computer systems. The invention is not limited to any particular implementation using software or hardware or firmware, or any combination thereof. The various elements of the system, either individually or in combination, may be implemented as a computer program product tangibly embodied in a machine-readable storage device for execution by a computer processor. For example, according to certain aspects of the above invention, a program may be provided for execution on a remote computer or other device, such as the computer 28 of FIG. 1. That program, for suitable embodiments would be provided on a computer readable medium or stored on a computer readable medium and would allow performance of the steps described above with respect to communication over the worldwide web and use or generation of the graphical user interface as described above. Similarly, according to another aspect of the certain embodiments of the above invention, software for performing the functions described above to be performed by a monitoring service provider 24 could be provided on a computer readable medium. Various steps of the process may be performed by a computer processor executing a program tangibly embodied on a computer-readable medium to perform functions by operating on input and generating output. Computer programming languages suitable for implementing such a system include procedural programming languages, object-oriented programming languages, and combinations of the two.

While many of the above embodiments are described with reference to a computer, microcomputer or microcontroller, the actual limitation device according to the present invention need not involve such devices. For example, the microcontroller used in the portable monitor may instead be implemented as special purpose hardware, firmware, software in a general purpose computer or any combination of these.

It is to be understood that while the invention has been described in conjunction with the detailed description thereof, the foregoing description is intended to illustrate and not limit the scope of the invention, which is defined by the scope of the appended claims. Other aspects, advantages, and modifications are within the scope of the following claims.

What is claimed is

1. A device comprising:

a sensor that generates signals corresponding to at least one physical or environmental condition relating to the person,

a processor that processes the signals to determine a characteristic of the condition, and

a transmitter that transmits a message to a telecommunication service provider in response to the determined characteristic of the physical or environmental condition.

2. The device of claim 1 wherein the determined characteristic is an alarm condition.

3. The device of claim 1 wherein the transmitter is a paging transmitter.

4. The device of claim 3 wherein the transmitted message includes data representing the determined characteristic.

5. The device of claim 1 further comprising at least one other sensor generating signals corresponding to at least one other physical or environmental condition relating to the person.

6. The device of claim 5 wherein the processor processes the signals from the at least one other sensor to determine the characteristic of the physical or environmental condition.

7. The device of claim 1 wherein processing the signals includes comparing a value associated with the signals to a predetermined threshold.

8. The device of claim 1 further comprising a memory storing information controlling operations of the processor and a receiver that receives instructions, through the telecommunication service provider, modifying the information.

9. The device of claim 1 further comprising a portable frame constructed to be attached to a person, wherein the sensor is coupled to the frame.

10. The device of claim 9 wherein the processor and the transmitter are coupled to the frame.

11. The device of claim 9 wherein the frame is a housing.

12. The device of claim 1 wherein the sensor comprises an ambient temperature sensor.

13. The device of claim 1 wherein the sensor comprises an accelerometer.

14. The device of claim 1 wherein the sensor comprises an audio sensor.

15. The device of claim 1 wherein the transmitter transmits an a status OK message to the telecommunication service provider.

16. A method comprising:

sensing at least one physical or environmental condition relating to the person;

processing, at a processor, the signals to determine a characteristic of the condition, and

transmitting a message to a telecommunication service provider in response to the determined characteristic of the physical or environmental condition.

17. A device comprising

a portable frame,

a sensor, coupled to the portable frame, that generates signals corresponding to at least one environmental condition of a person,

a processor, coupled to the portable frame, that processes the signals to determine a

characteristic of the environmental condition.

18. The device of claim 17 wherein the environmental condition is caused by the person.

19. The device of claim 18 wherein the environmental condition is crying by the person.

20. The device of claim 17 wherein the environmental condition is caused by a second person.

21. The device of claim 20 wherein the environmental condition comprises force being applied by the second person to the first person.

22. The device of claim 20 wherein the environmental condition comprises the second person shouting at the first person.

23. The device of claim 17 further comprising a transmitter that transmits a message to a telecommunication service provider in response to the determined characteristic of the environmental condition.

24. A method comprising

generating signals corresponding to at least one environmental condition relating to the person, wherein the signals are generated by a sensor coupled to a portable frame; and

processing, at a processor coupled to a portable frame, the signals to determine a characteristic of the environmental condition.

25. A device comprising:

a sensor that generates signals corresponding to at least one physical or environmental condition relating to the person,

a processor that processes the signals to detect an alarm condition, and

a transmitter that transmits a message indicating the alarm condition.

26. A method comprising

generating signals corresponding to at least one environmental condition relating to the person. and

processing, at a processor, the signals to detect an alarm condition, and

transmitting a message indicating the alarm condition.

27. A system comprising

a receiver to receive information from a telecommunication service provider, wherein the information is transmitted by a portable monitoring device attached to a person, the information indicating a characteristic of at least one physical or environmental condition of the person, and

a transmitter to transmit the information over a network to a computer.

28. The system of claim 27 wherein the system comprises and the portable monitoring device includes:

a portable frame constructed to be attached to the person;

a sensor, coupled to the frame, generating signals corresponding to the at least one physical or environmental condition relating to the person;

a processor, coupled to the frame, processing the signals to determine the characteristic of the physical or environmental condition.

29. The system of claim 27 further comprising a network port for connection to the network.

30. The system of claim 29 wherein the network is the World Wide Web.

31. A computer-implemented method comprising

receiving information from a telecommunication service provider, wherein the information is transmitted by a portable monitoring device attached to a person, the

information indicating a characteristic of at least one physical or environmental condition of the person, and

transmitting the information over a network to a computer.

32. A system comprising

a receiver to receive information from a telecommunication service provider, wherein the information is transmitted by a portable monitoring device attached to a person, the information indicating a characteristic of at least one physical or environmental condition of the person, and

a database to store data corresponding to the information.

33. The system of claim 32 wherein the system comprises and the portable monitoring device includes:

a portable frame constructed to be attached to the person;

a sensor, coupled to the frame, generating signals corresponding to the at least one physical or environmental condition relating to the person,

a processor, coupled to the frame, processing the signals to determine the characteristic of the physical or environmental condition.

34. The system of claim 32 wherein the stored data includes data received from the device characterizing the information.

35. The system of claim 32 further comprising a network port for connection to a network.

36. The system of claim 35 further comprising a server connected to the network port and to the database, the server allowing a plurality of subscribers to a service provider to connect to the server through the network to access the database.

37. The system of claim 36 wherein the server causes computers of the subscribers to display a graphical user interface for accessing the database.

38. The system of claim 35 wherein the network is the World Wide Web.

39. A computer-implemented method comprising:

receiving information from a telecommunication service provider, wherein the information is transmitted by a portable monitoring device attached to a person, the information indicating a characteristic of at least one physical or environmental condition of the person,

storing data corresponding to the information in a database.

40. A system comprising:

a receiver that receives information transmitted by a portable monitoring device attached to a person, the information indicating a characteristic of at least one physical or environmental condition of the person;

a processor that processes the information to provide instructions to cause a computer to display on a computer display a graphical user interface that includes information corresponding to the characteristic of the physical or environmental condition of the person and an advertisement by a vendor; and

a sender that sends the instructions to a computer.

41. The system of claim 40 wherein the system comprises and the portable monitoring device includes:

a portable frame constructed to be attached to the person;

a sensor, coupled to the frame, generating signals corresponding to the at least one physical or environmental condition relating to the person,

a processor, coupled to the frame, processing the signals to determine the characteristic of the physical or environmental condition.

42. A computer-implemented method comprising:

receiving information transmitted by a portable monitoring device attached to a person, the information indicating a characteristic of at least one physical or environmental condition of the person,

processing the signal to provide instructions to cause a computer to display on a computer display a graphical user interface including information corresponding to the characteristic of physical or environmental conditions of the person and an advertisement by a vendor,

sending the instructions to a computer.

43. A graphical user interface comprising information transmitted by a portable monitoring device attached to a person, the information indicating a characteristic of at least one physical or environmental condition of the person and an advertisement by a vendor.

44. A computer implemented method comprising the step of causing a computer to display a graphical user interface comprising information transmitted by a portable monitoring device attached to a person, the information indicating a characteristic of at least one physical or environmental condition of the person and an advertisement by a vendor

45. A method comprising:

accepting subscriptions by subscribers;

receiving information transmitted by a monitoring device selected by at least one of the subscribers, the information indicating a characteristic of at least one physical or environmental condition of a person and forwarding the information to a computer of the subscriber.

46. The method of claim 45 further comprising:

accepting advertisements from vendors, and

forwarding the advertisements with the information to the computer of the subscriber.

47. The method of claim 46 wherein the subscribers subscribe for free.

48. The method of claim 45 further comprising:

charging the subscribers a subscription fee.

49. The method of claim 45 further comprising

providing a server connected to a network wherein the subscribers connect to the server through the network to receive the information.

50. The method of claim 49 wherein the network is the World Wide Web.

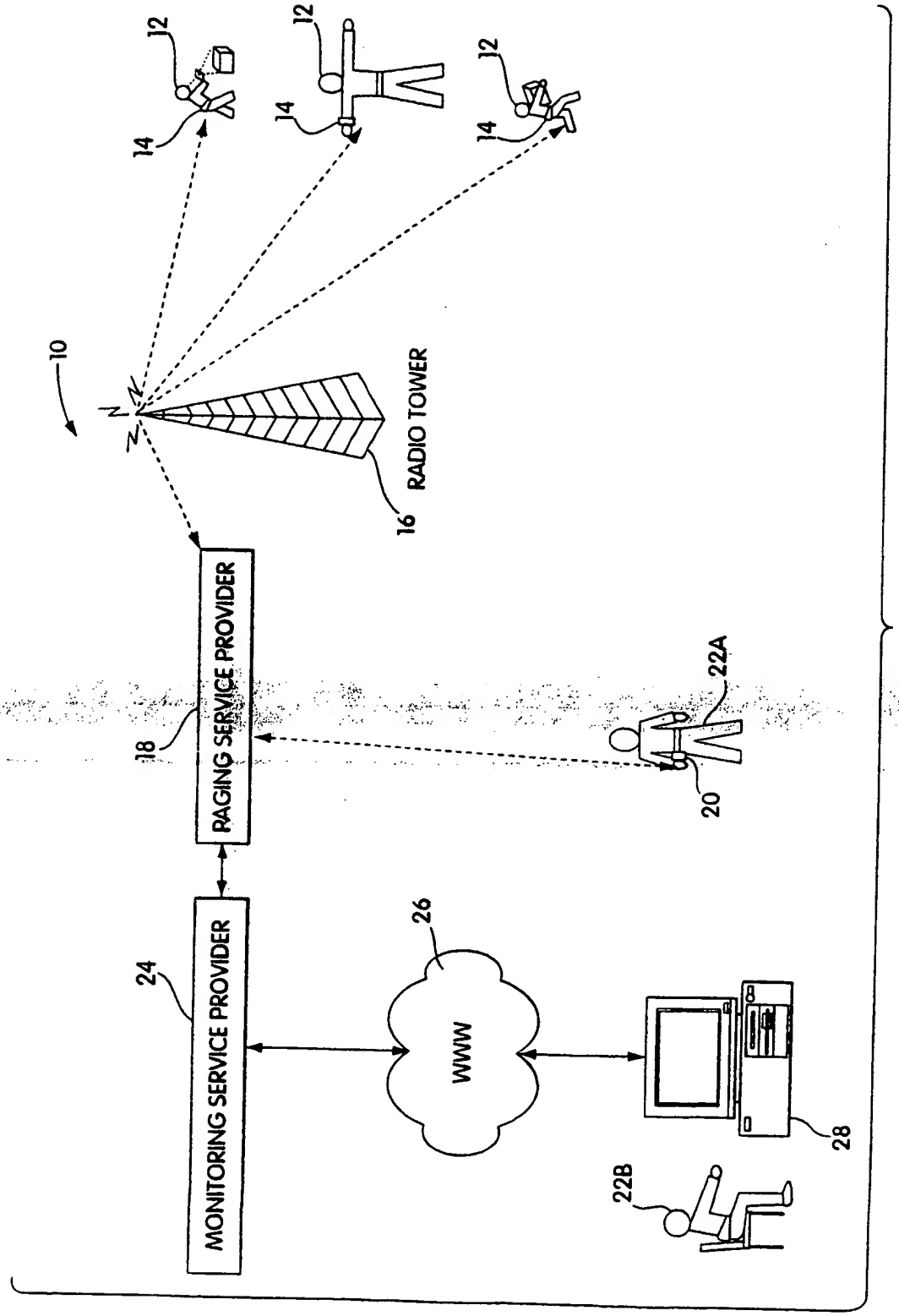

Fig. 1

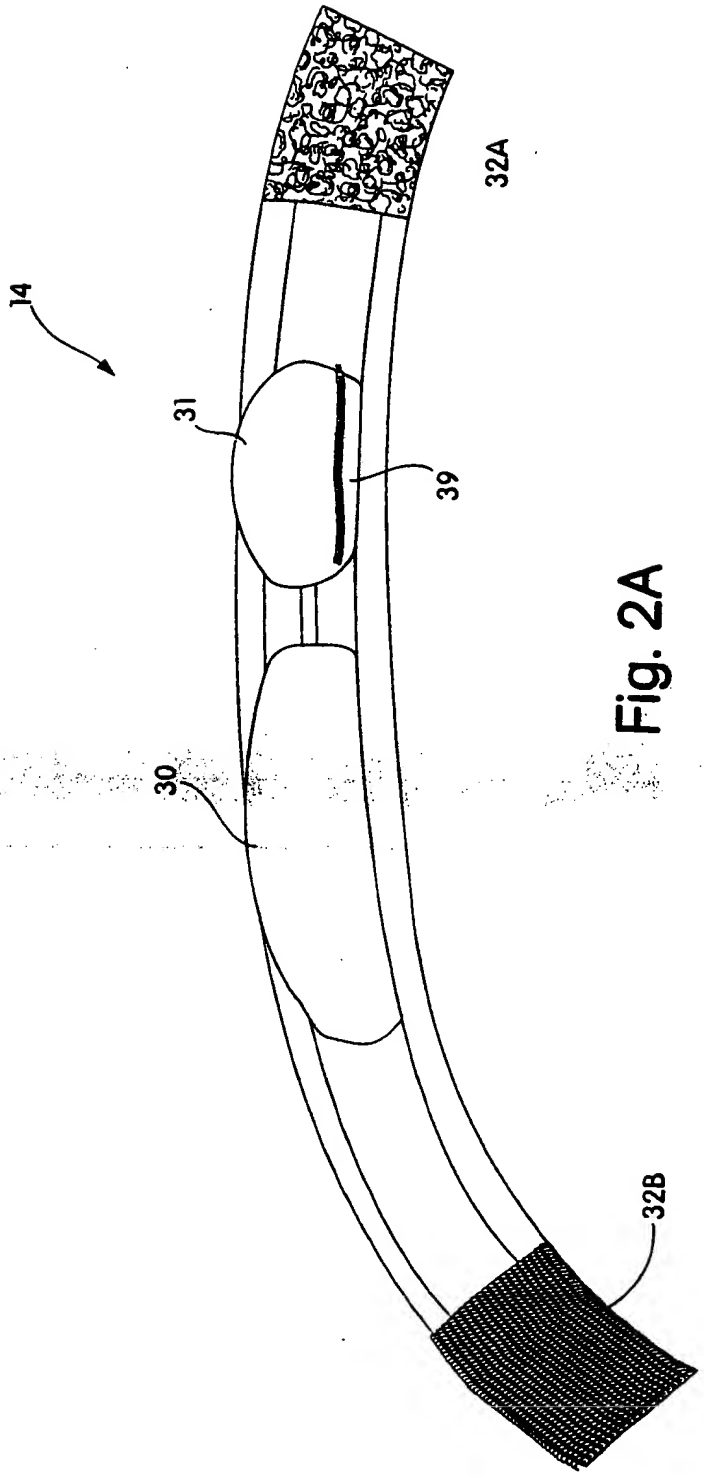

Fig. 2A

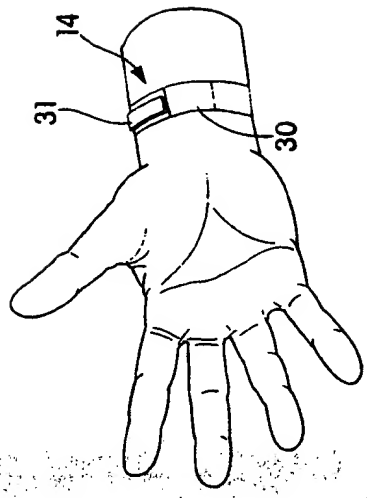

Fig. 2B

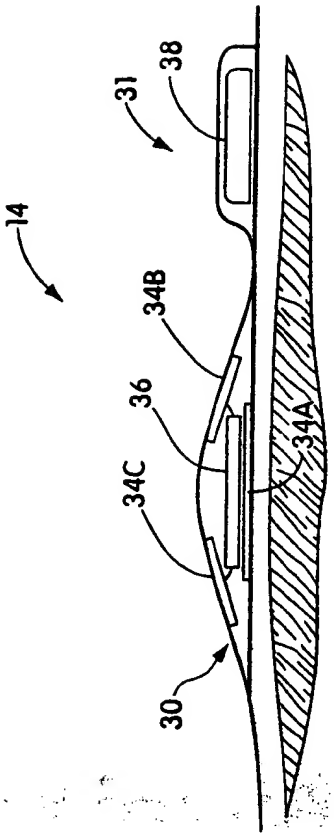

Fig. 2D

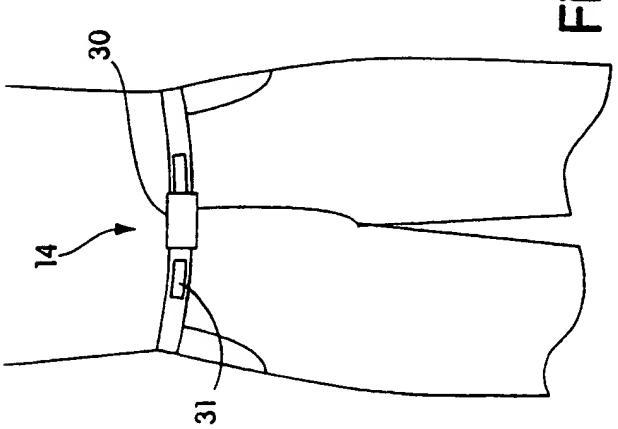

Fig. 2C

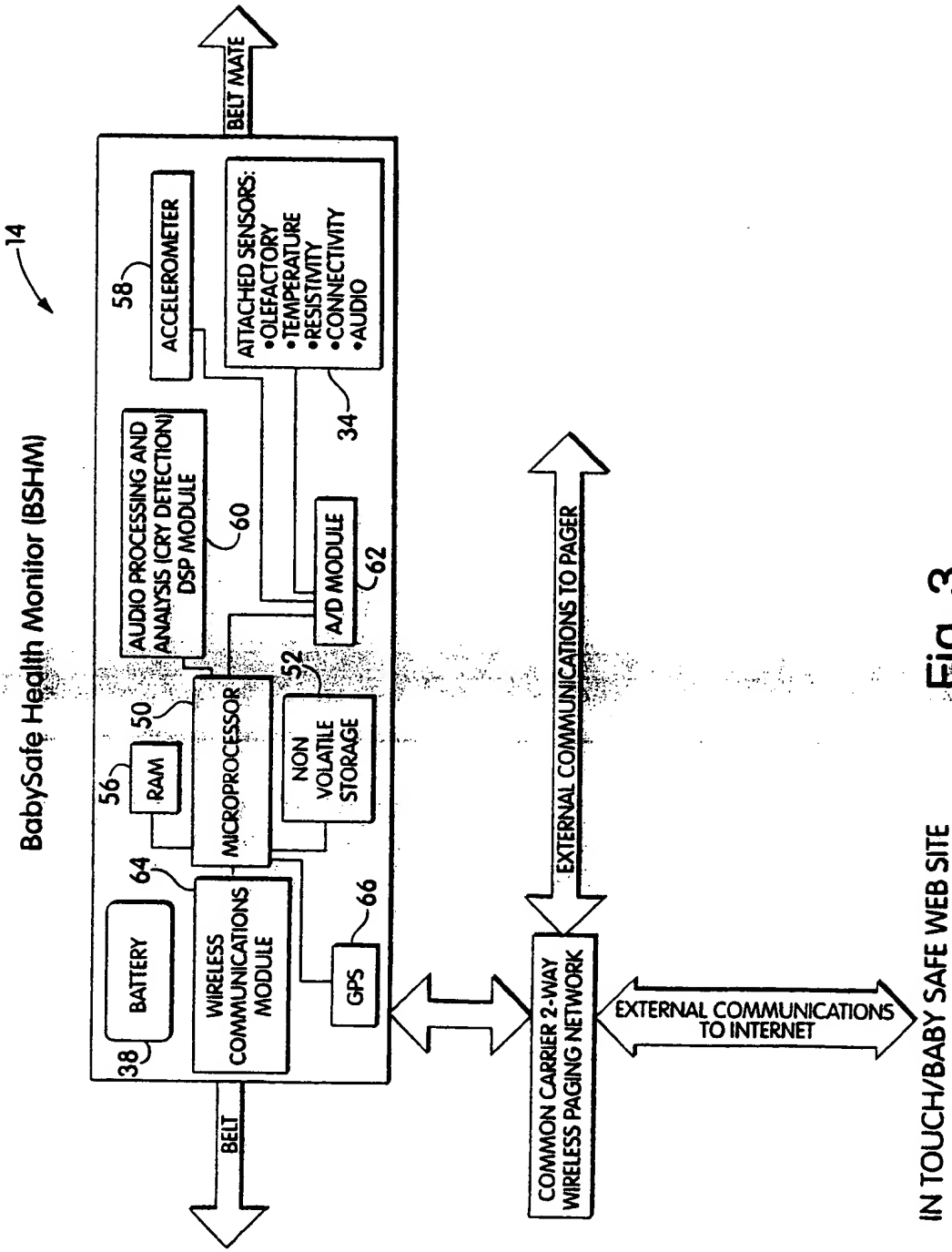

Fig. 3

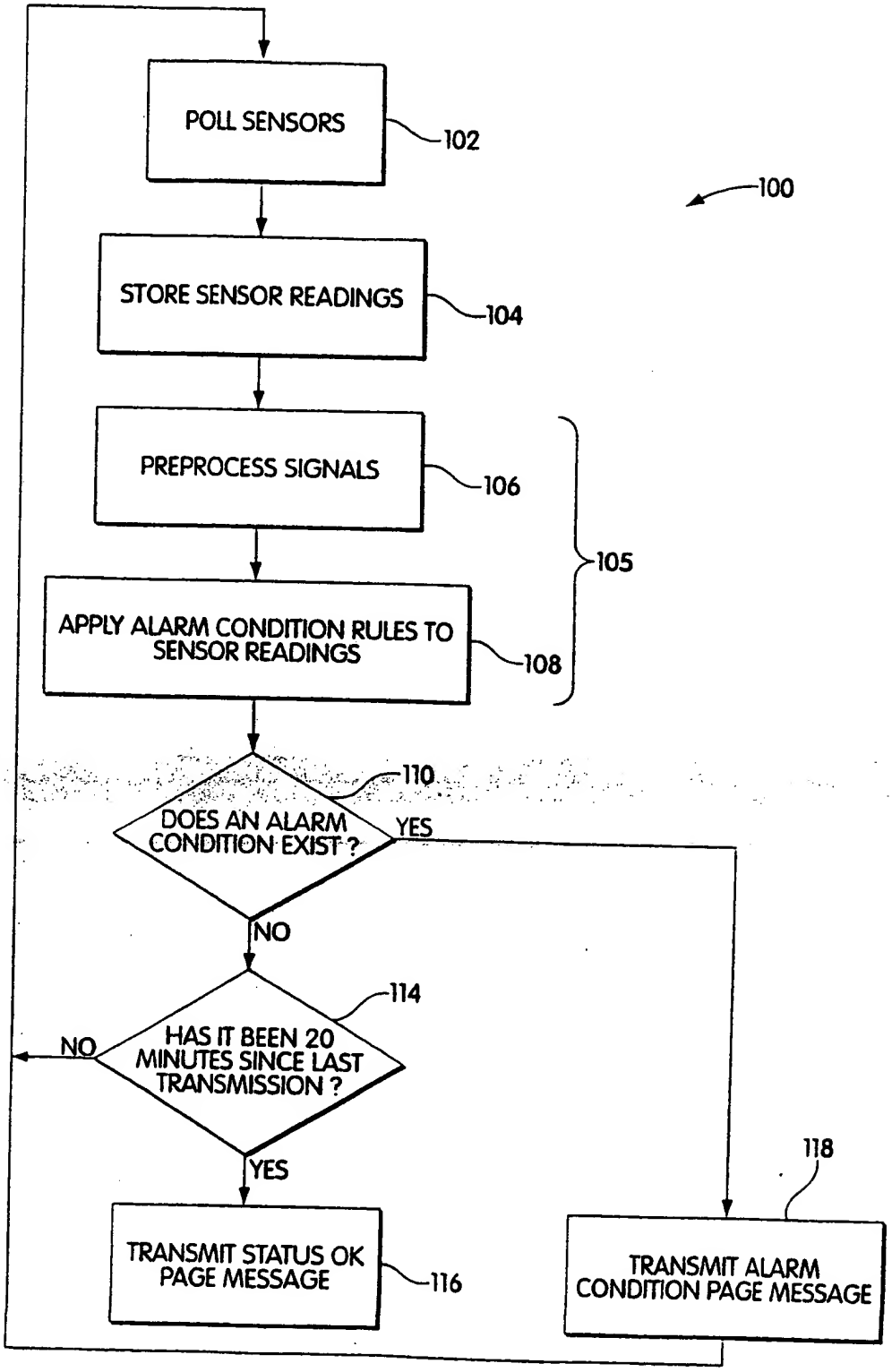

Fig. 4

Rules Samples

Temperature
- Use Running Average of Ambient
- Use Running Average of Skin
- Alarm on
  - Ambient higher than UPPER LIMIT1 for TIME1 — 122
  - or Ambient lower than LOWER LIMIT1 for TIME2 — 124
  - or Skin temp higher than UPPER LIMIT2 for TIME3 — 126
  - or Skin temp lower than LOWER LIMIT2 for TIME4 — 128
  - or Ambient-Skin higher than DIFF LIMIT1 for TIME5 — 130
  - or Ambient-Skin lower than DIFF LIMIT2 for TIME6 — 132

Noise
- Use Intensity (dB, loudness)
- Use Frequency Content
- Alarm on
  - Intensity in INTENSITY RANGE and Frequency within FREQUENCY RANGE for TIME7 — 134
  - or Intensity Peak to Intensity Peak Interval for TIME RANGE1 — 136

MOTION
- Use Acceleration
- Use Direction
- Use Velocity
- Alarm on
  - Acceleration higher than UPPER LIMIT3 — 138
  - or Acceleration lower than LOWER LIMIT3 — 140
  - or Rate of change of acceleration higher than LIMIT3 — 142

Fig. 5

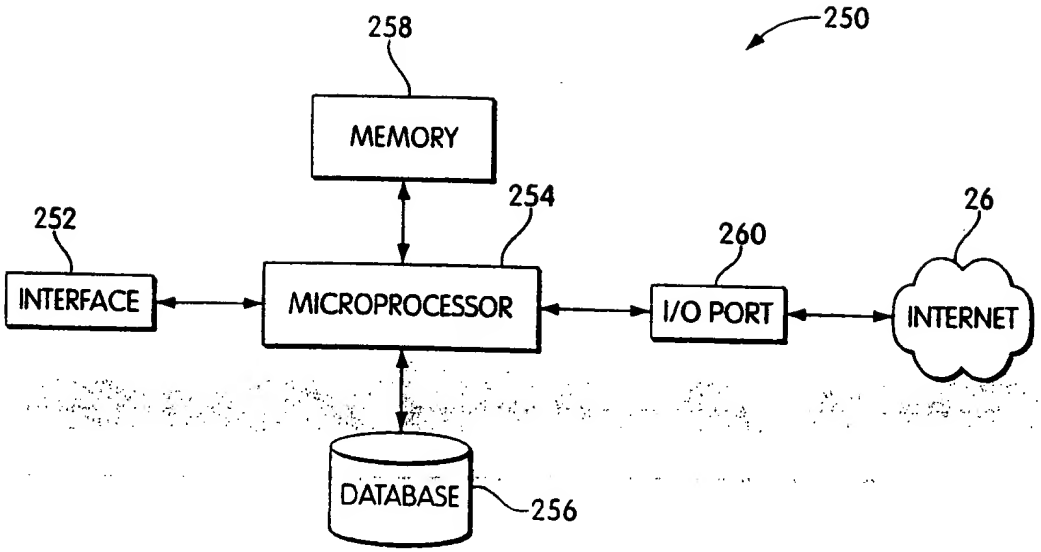

Fig. 6

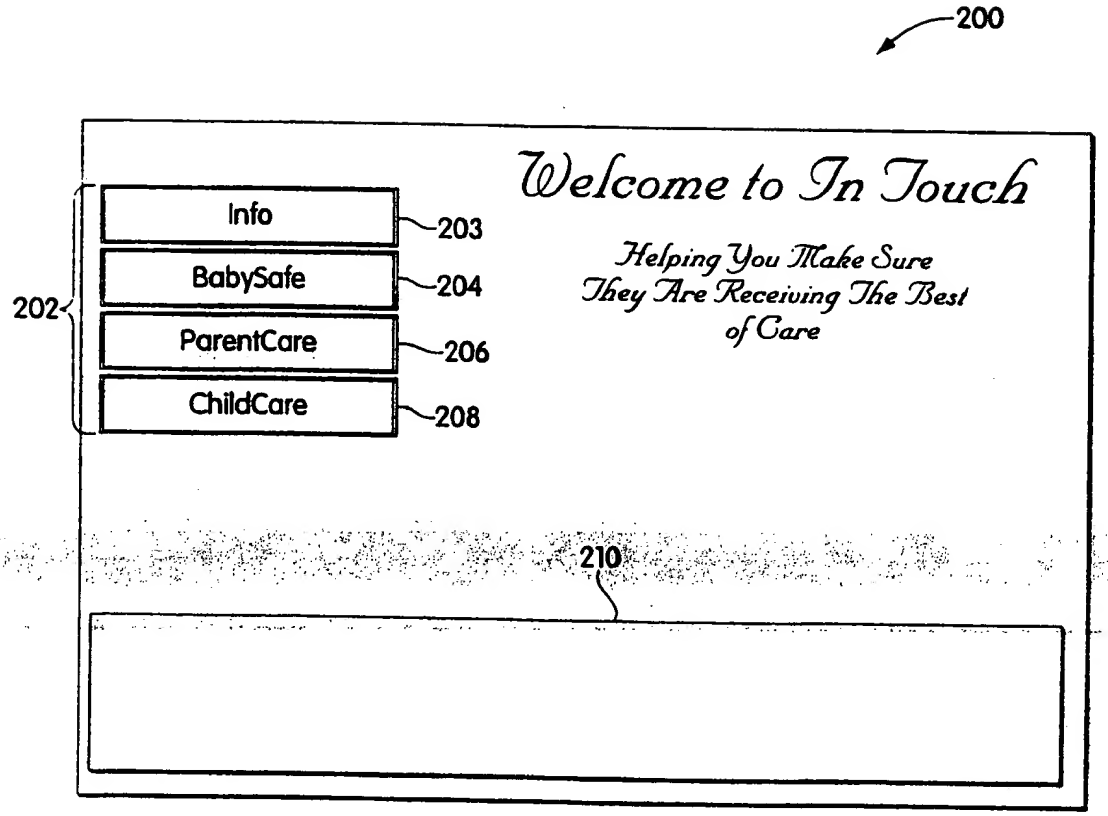

Fig. 7

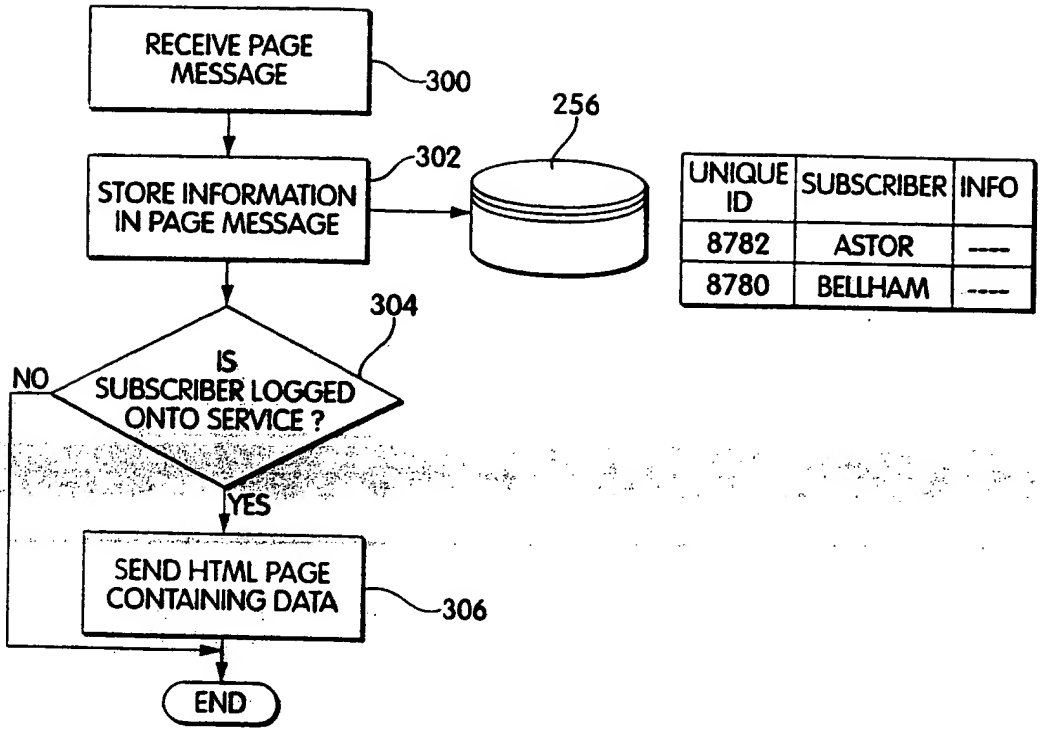

Fig. 8

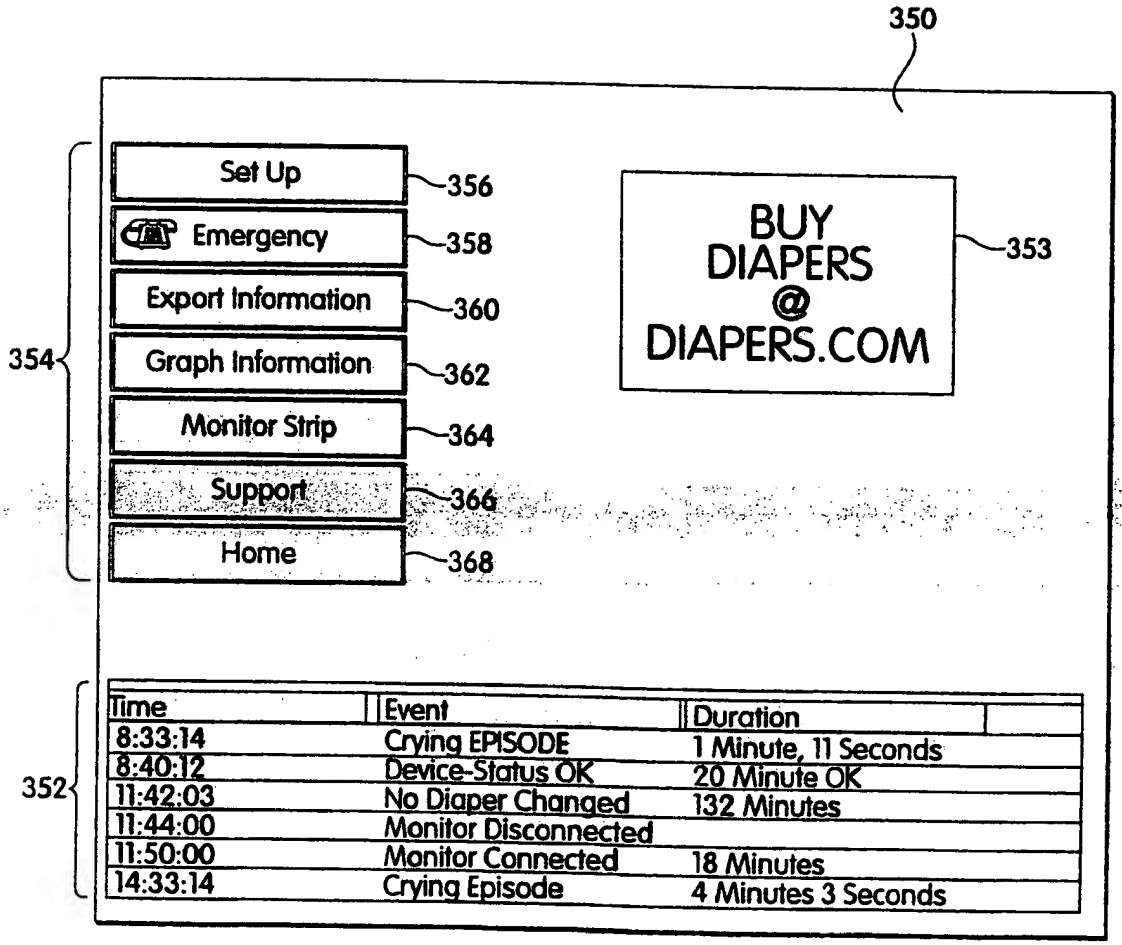

Fig. 9

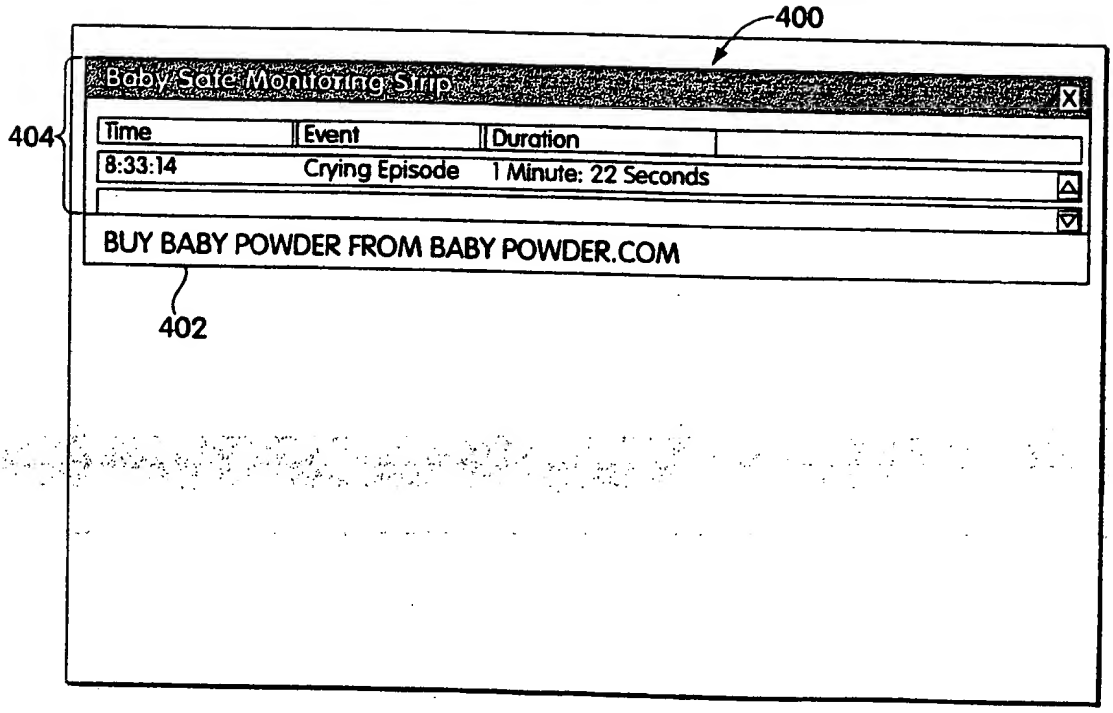

Fig. 10

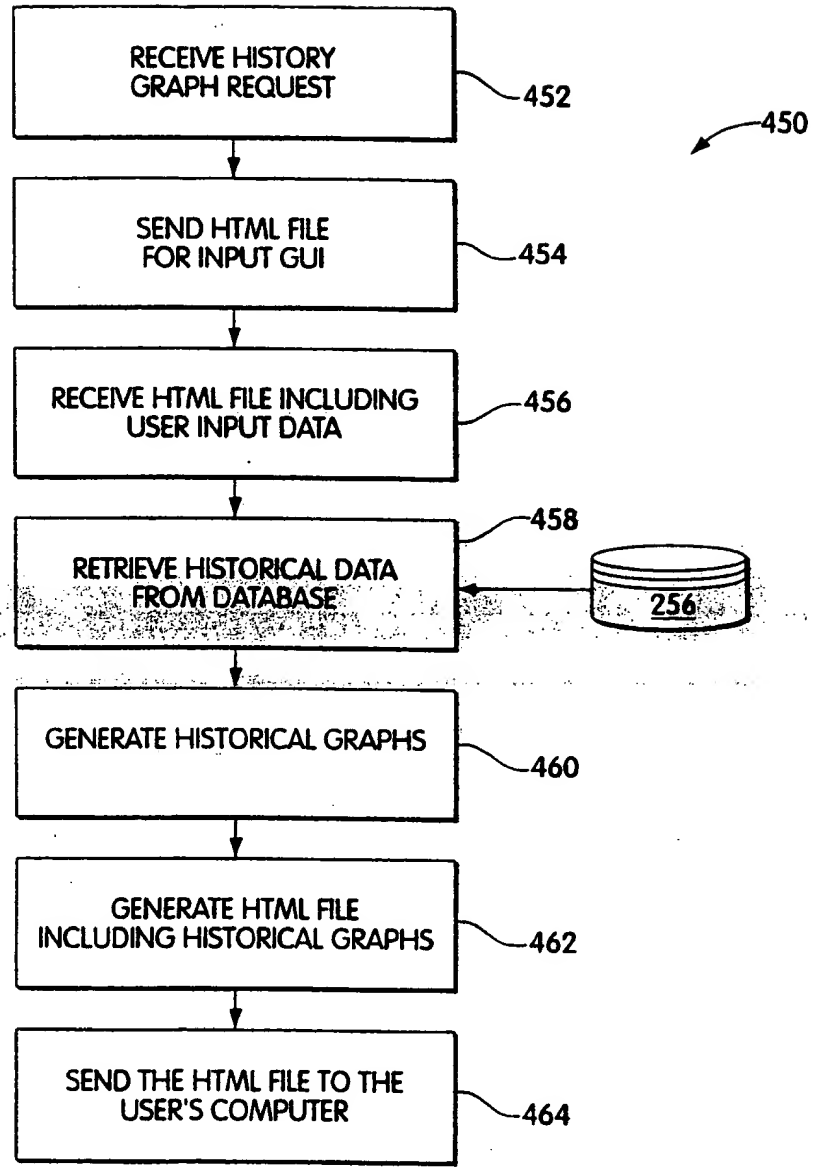

Fig. 11

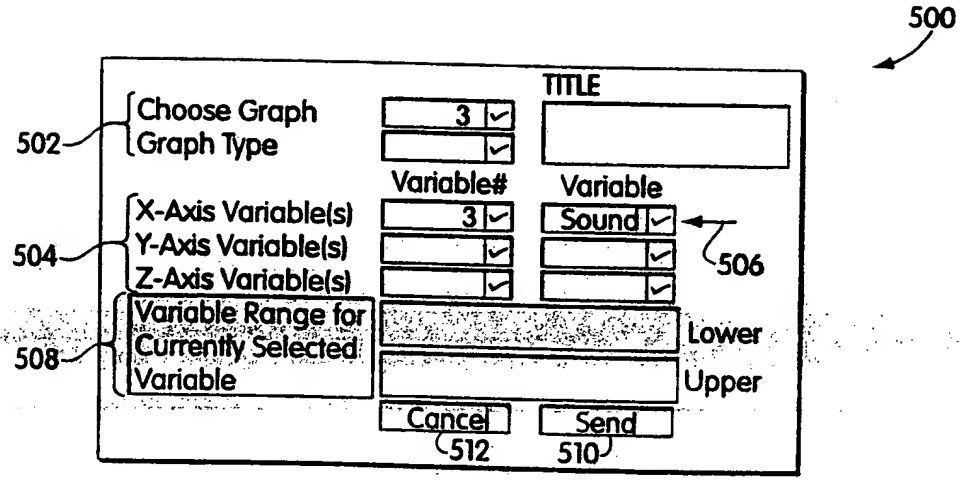

Fig. 12

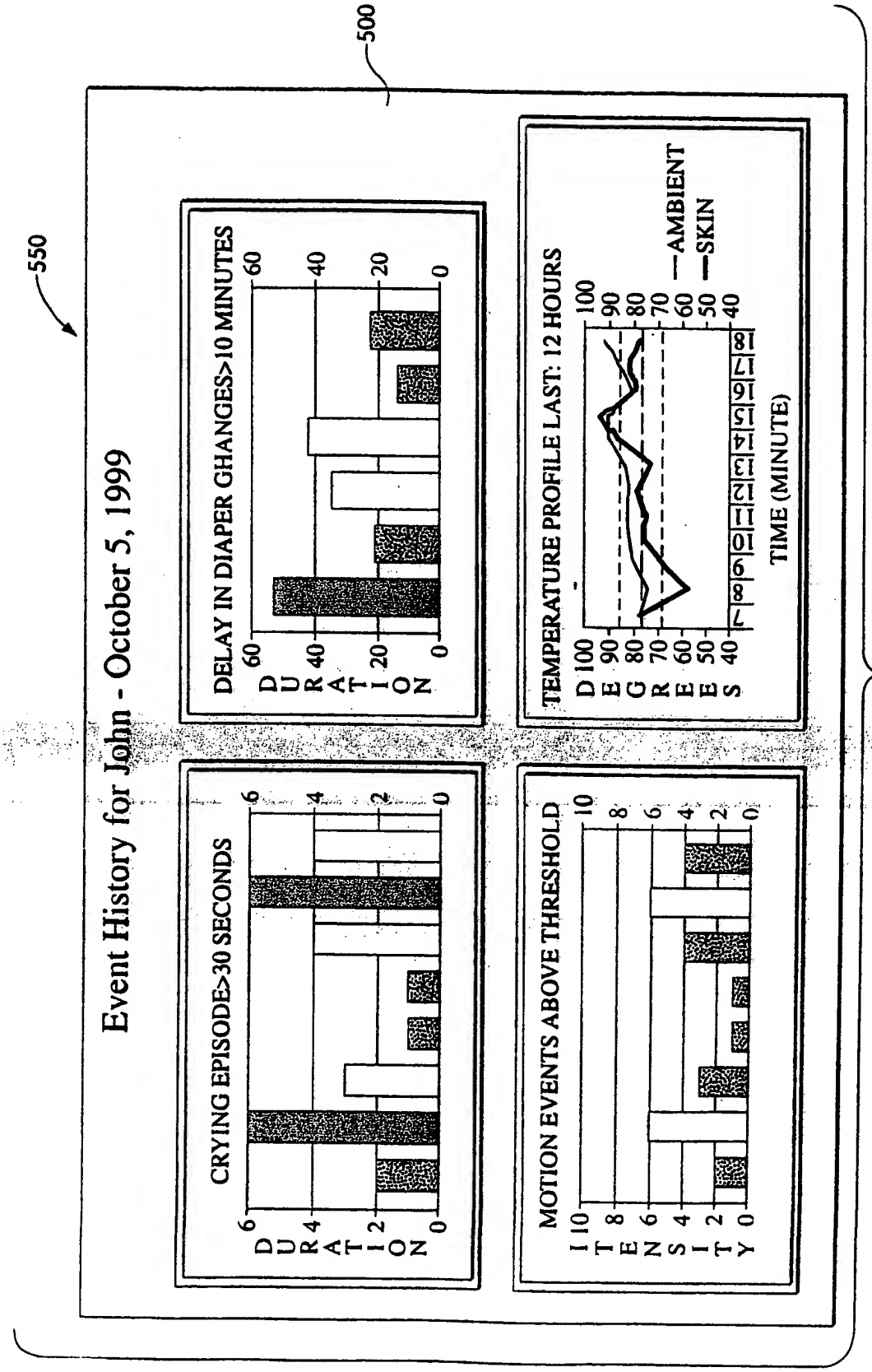

Fig. 13

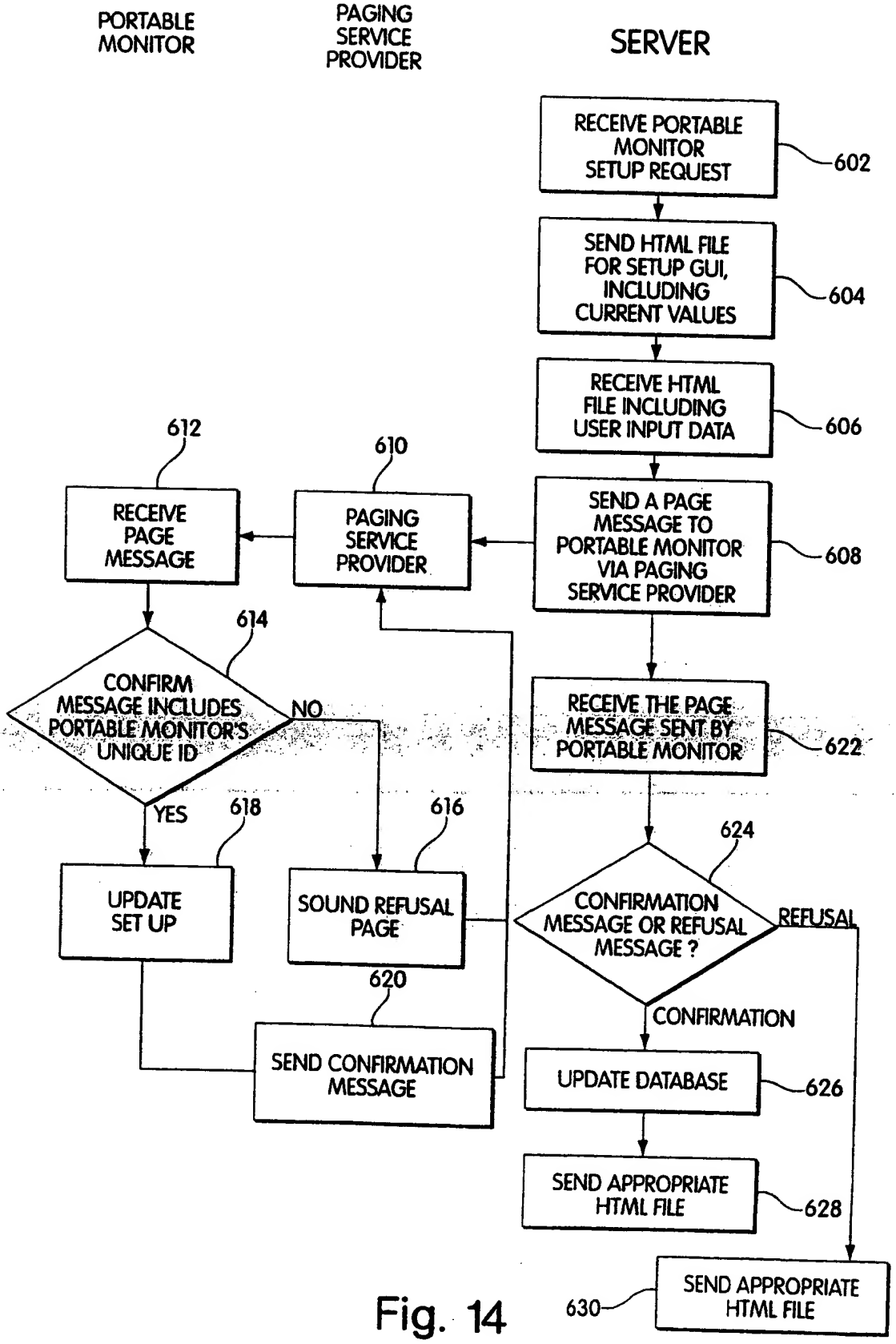

Fig. 14

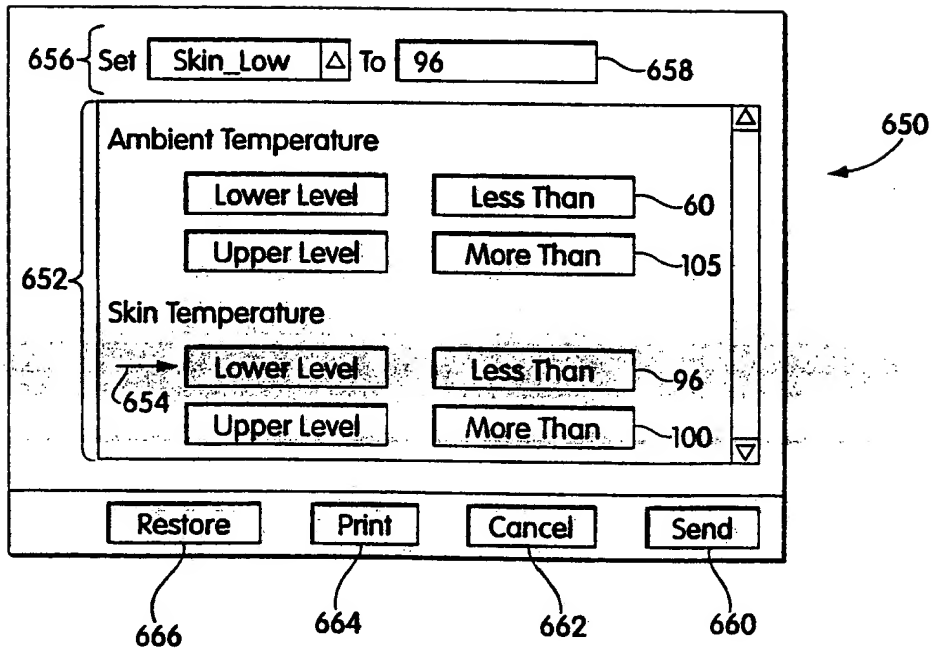

Fig. 15

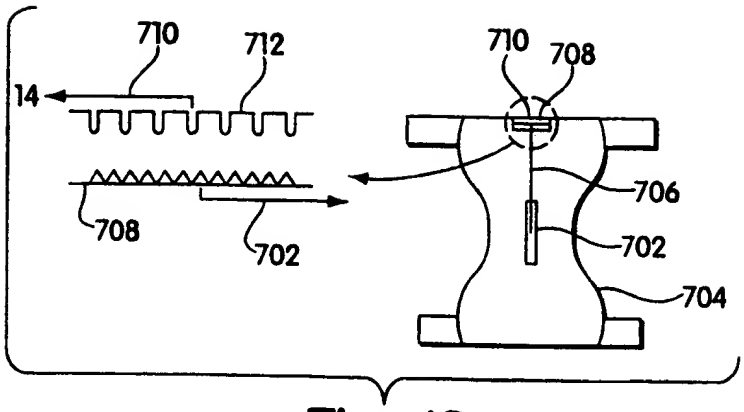

Fig. 16

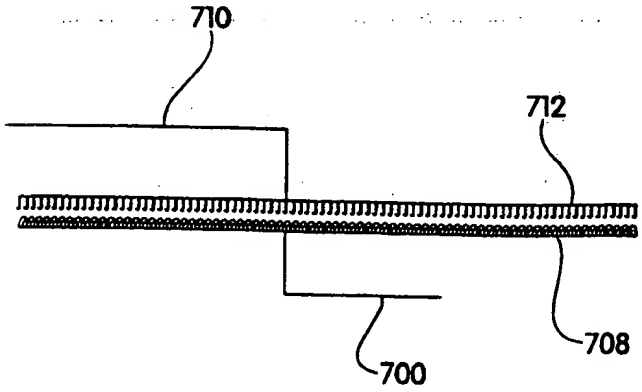

Fig. 16A

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : G08B 21/00 — A3

(11) International Publication Number: WO 00/26882

(43) International Publication Date: 11 May 2000 (11.05.00)

(21) International Application Number: PCT/US99/25554

(22) International Filing Date: 29 October 1999 (29.10.99)

(30) Priority Data:
60/106,404 30 October 1998 (30.10.98) US

(71) Applicant: STRATEGIC PRODUCT DEVELOPMENT [US/US]; 9 Meriam Street, Lexington, MA 02420 (US).

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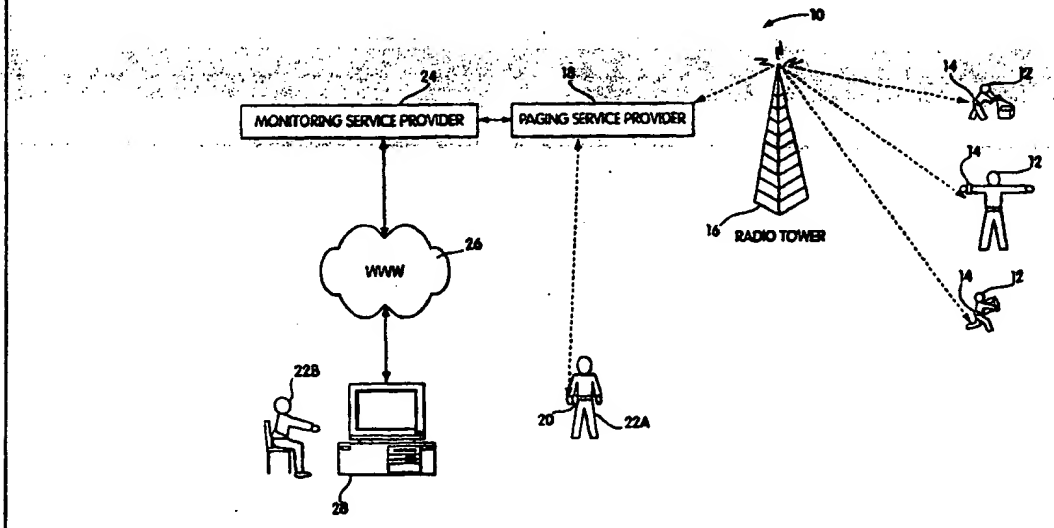
(74) Agent: LOWRIE, Matthew, B.; Wolf, Greenfield & Sacks, P.C., 600 Atlantic Avenue, Boston, MA 02210 (US).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(88) Date of publication of the international search report:
28 September 2000 (28.09.00)

(54) Title: MONITORING PHYSICAL AND ENVIRONMENTAL CONDITIONS OF A PERSON



(57) Abstract

A monitoring device includes a sensor that generates signals corresponding to at least one physical or environmental condition relating to the person (14); a processor that processes the signals to determine a characteristic of the condition; and a transmitter that transmits a message to a telecommunication service provider in response to the determined characteristic of the physical or environmental condition. The telecommunication service provider can be any type of telecommunication service provider (18) including a paging service provider, a local service provider, a long-distance service provider, an internet service provider, a cellular phone service provider, or any combination of these service providers. The message can then be forwarded to a subscriber of a monitoring service provider. The monitoring service provider (24) can provide various graphical user interface windows over a network, such as the World Wide Web (26), to the subscriber to view the information.

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INTERNATIONAL SEARCH REPORT

Int. ational Application No
PCT/US 99/25554

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G08B21/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G08B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 97 06499 A (CEDARS SINAI MEDICAL CENTER) 20 February 1997 (1997-02-20) the whole document	1-7,16, 25,26 9-11,13, 14,17, 18,24, 27-29, 31-35,39

Y	US 5 771 001 A (COBB MARLON J) 23 June 1998 (1998-06-23) the whole document	9-11,17, 18,24, 27-29, 31-35,39

Y	US 5 726 631 A (LIN WEN-JUEI) 10 March 1998 (1998-03-10) the whole document	13

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
7 February 2000	-5 07 2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	KELPERIS K.

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/25554

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB 2 322 952 A (GAKKEN) 9 September 1998 (1998-09-09) the whole document	14
X	WO 93 01574 A (RUSSEK LINDA G) 21 January 1993 (1993-01-21) the whole document	1-7,16, 25,26
X	US 5 581 238 A (CHANG MEI-HUI ET AL) 3 December 1996 (1996-12-03) the whole document	1,2,5-7, 16,25,26
X	WO 94 25841 A (GRUPO K & F REGAL SA ;MARTINEZ PORTUGAL CONRADO (ES)) 10 November 1994 (1994-11-10) the whole document	1-7,16, 25,26
A	H.LEE ET AL: "REMOTE PATIENT MONITORING SERVICE THROUGH WORLD-WIDE WEB" PROCEEDINGS OF THE 19-TH INTERNATIONAL CONFERENCE-IEEE/EMBS, vol. 2, 30 October 1997 (1997-10-30), pages 928-931, XP002129894 USA the whole document	29,30,38

1

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 99/25554

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

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because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

SEE ANNEX

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

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1-39

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

1. Claims: 1-39

A device comprising a sensor that generates signals related to a person and a transmitter

2. Claims: 40-44

A system comprising a receiver ,a computer with a graphical user interface and a sender

3. Claims: 45-50

A method comprising accepting subscriptions and receiving information by a monitoring device

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 99/25554

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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